This question was asked of a high school math class by the owner of a fabric store. A lady needed to buy enough canvas to make two teepees and a sweatlodge. The fabric is 5 feet wide. How many yards will she need?

Teepee #1, with diameter 40 feet and height 20 feet:

Teepee #2    
Diameter 32 feet and hieght 16 feet

#3 the Sweat Lodge Semidome: Radius=7 ft, height=4 ft (help students realize this is not a hemishphere; it is a semidome)

The canvas comes in a 5 foot width.

**Suggested Solution**  
  
Teepee #1, with diameter 40 feet and height 20 feet:  
The slant height of this teepee is 28.28 feet.  The surface area (using a cone) is 1,777 square feet.  Using fabric that is 5 feet wide (60 inches) that is 356 feet off the bolt.  (356X5=1780 square feet)  
  
Cutting the fabric:  
  
The circumference of the teepee is about 126 feet.  So laying out the panels of fabric, if you cut each panel 29 feet, and then cut the rectangle on the diagonal, tip one triangle over and stitch it together, you would get a triangle that is 10 feet along base and 129 feet high. so it would take 13 of these to go around the base circumference, so now you are looking at 13 panels cut 129 feet long = 377 feet off the bolt, slightly more than the straight area calculation so there is a little waste.  
  
Teepee #2    
Diameter 32 feet and hieght 16 feet  
Slant height of this teepee is 22.63 feet.  
Surface area is (pi)(radius)(slant height) so (3.14159)(16)(22.63)= about 1138 square feet.  
  
At a 5 foot width, that is 1138/5=227.5 so about 228 feet off the bolt  
  
Cutting the fabric:  
Circumference of this teepee is (pi)(diamter)=(3.14159)(32)=100.5 feet  
  
So a little more than 10 panels at 5 foot width (using the triangle method as before) and you need the panels about 23 feet long, so that's (10)(23) = 230 feet off the bolt, but that wont quite be enough. You'll have to sew in another little bit, only a few inches wide but 23 feet long.  Anyway, 230X5=1150 (plus a little bit!)  square feet of fabric; again, a little more than direct area calculation.  
  
  
#3 the Sweat Lodge  
Ok, this one is a guess, because its not truly a hemisphere.  
I started with a hemisphere with radius 7 feet, but the height would be 7 feet also.  The surface area of that would be about 308 square feet.  Now this is not a true hemisphere, its kind of a semi-dome, so to be safe lets assume 2/3 of the area of a hemishpere (because the height is only 4 feet not 7 feet.)  
  
so 2/3 of 308 square feet is 203 square feet, at 5 feet wide that is 203/5=about 41 feet off the bolt.  
  
But there is a problem because of the curvature of the sides:    
So Cutting the fabric:  
I think you'd have to use the bottom of each panel along the circumference, which is 44 feet.  So 44/5 means about 9 panels. How long should the panels be? Well if it was a cone the slant height would be 8.1 feet, but you'll have to add to that because the sides aren't straight like a cone, they are curved. So say 10  feet. At 10 feet that is 9 panels or 90 feet off the bolt, for a total of (90)(5) = 450 square feet, way more than the actual area of 203 square feet. Lots of waste here.  
  
Another calculation for surface area of the dome gives me:  
SA = 2(pi)(radius)(height)  
       =2(3.14159)(7)(4)=176 square feet.  So just because you have to sew a circle I think there will be considerable waste on this one.  
  
  
**Final Estimate** :  
Actual area = 1777 + 1138 + 176 = 3091 square feet;  at 60 inch (5 foot) width that is **618.2 feet off the bolt of 5 foot width fabric**.  
  
But:   
Area considering cutting, and accomodating the circle without making "patchwork"  
would be:   
Teepee 1:  13 panels at 28.3 feet = 368 feet off the bolt (1839.5 square feet)  
Teepee 2:  11 panels at 23 feet =253 feet off the bolt (1265 square feet)  
Sweat Lodge:  (there may be a better way but....)  9 panels at 10 feet each = 90 feet off the bolt (450 square feet)  
  
**Total = 711 feet off the bolt of 5 foot width fabric.**